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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the manufacturing method of the ink jet head for recording by making an ink droplet breathe out from a nozzle hole.

[0002] An ink jet recording method is simple for structure, tends to carry out colorization, has the strong points, like there is also no noise, and is expected as a future recording mode being in use. This invention is a thing especially about the manufacturing method of a recording head of an ink-jet recording device.

[0003]

[Description of the Prior Art] The conventional ink jet head constitutes an ink channel part and a nozzle part from inorganic materials, such as metal and a silicon single crystal wafer. A pressure chamber, a nozzle hole, etc. are formed there by etching processing, or an ink channel part and a nozzle part are constituted from photo-curing resin, and a light shielding mask is put on the position used as a pressure chamber, a nozzle hole, etc., it irradiates with ultraviolet rays, and the pressure chamber and the nozzle hole are made to be formed as a non-hardening portion.

[0004]

[Problem to be solved by the invention] However, in the case of etching processing, since a processed surface becomes tapering form gradually, there is a fault in which it is difficult to form in an exact shape dimension the nozzle hole where strict dimensional accuracy is searched for.

[0005] On the other hand, if photo-curing resin is used, accuracy will be improved by processing of a nozzle hole, but there is a fault from which the nozzle plate itself vibrates with the pressure from a driving source since the mechanical strength of material is weak, therefore print quality enough the discharge velocity of an ink droplet and good is not acquired.

[0006] Then, this invention can form a nozzle hole with high precision, and an object of this invention is to provide the manufacturing method of the ink jet head which can acquire the print quality where a nozzle plate moreover did not vibrate easily, and which was stabilized with sufficient discharge velocity of the ink droplet.

[0007]

[Means for solving problem] In order to attain the above-mentioned purpose, the manufacturing method of the ink jet head of this invention, The substrate 1 is punctured so that the opening of the hole 5 thicker than the path of the nozzle hole 9 for making an

ink droplet breathe out from the pressure chamber 3 as shown in drawing 1 for describing an working example may be carried out into the above-mentioned pressure chamber 3, After having filled up the above-mentioned hole 5 with the photo-curing resin 7, having irradiated the above-mentioned photo-curing resin 7 where the portion which becomes the nozzle hole 9 is shaded, and stiffening the above-mentioned photo-curing resin 7, It is good to be characterized by removing the uncured part of the above-mentioned photo-curing resin 7 from the inside of the above-mentioned hole 5, and forming the nozzle hole 9, and to form the above-mentioned substrate 1 with an inorganic substance.

[0008]

[Function]The bigger hole 5 than the path of the nozzle hole 9 is drilled by the portion which becomes the nozzle hole 9, and it fills up with the photo-curing resin 7 in the hole 1. And except the portion which becomes the nozzle hole 9, an optical exposure hardens and the nozzle hole 9 is formed by removing an uncured part.

[0009]On the other hand, nozzle plates other than the portion which becomes the nozzle hole 9 are formed by substrate 1 the very thing.

[0010]

[Working example]An working example is described with reference to Drawings. In order to manufacture the ink jet head of this working example, First, as shown in drawing 2, by etching processing, it is open for free passage to the ink feed path 2 where the graphic display is omitted, and the pressure chamber 3 is dented and formed in the rear-face side of the substrate 1 which consists of inorganic substances, such as a silicon single crystal wafer or stainless steel.

[0011]Drawing 3 is the flat-surface sectional view, and many pressure chambers 3 are open for free passage to the ink feed path 2, and it is formed along with the one substrate 1. And in this pressure chamber 3, as shown in drawing 4, it is filled up with the filler 4 which heated polyethylene-glycol \*\*4000 at 80 \*\*, and made it liquefied, and a room temperature is returned and solidified.

[0012]Next, as shown in drawing 5, the opening of the end is carried out into the pressure chamber 3 so that the hole 5 of a path thicker than a path of a nozzle hole (9 mentioned later) for making an ink droplet breathe out from the inside of the pressure chamber 3 may not be protruded from the pressure chamber 3, and it forms by etching processing so that it may penetrate in the pressure chamber 3 from the surface side of the substrate 1.

[0013]And as shown in drawing 6, it is filled up with the photo-curing resin 7 which will be hardened if light hits in the hole 5, and as shown in drawing 7, the light shielding mask 8 for shading a portion which becomes a nozzle is placed on the surface of the photo-curing resin 7. As the light shielding mask 8, a glass mask which carried out chromium vacuum evaporation, for example can be used.

[0014]Since it is made such, as shown in drawing 1, it irradiates with the ultraviolet rays of 60 mV / cm<sup>2</sup> for 5 seconds vertically from the surface side of the substrate 1. By doing in this way, as shown in drawing 7, portions other than the back side of the light shielding mask 8 harden the photo-curing resin 7.

[0015]Then, by exfoliating from the surface of the photo-curing resin 7, and cleaning the light shielding mask 8 ultrasonically for 40 seconds, using solvents, such as acetone, as shown in drawing 8, the uncured part of the photo-curing resin 7 elutes, and the nozzle hole 9 is formed. And nozzle plate 10 portion is formed by the substrate 1.

[0016]Next, by soaking the substrate 1 whole in underwater [ which was heated, for

example at 80 \*\*, as shown in drawing 9, the filler 4 elutes and it is removed from the inside of the ink feed path 2 and the pressure chamber 3.

[0017]And finally, as shown in drawing 10, the diaphragm 11 is pasted up on the rear-face side of the substrate 1, each pressure chamber 3 and a position are doubled and the piezoelectric device 12 is further pasted up on the outside surface side of the diaphragm 11.

[0018]Thus, an ink jet head is made. Drawing 11 is the ink jet head seen from the nozzle hole side. Thus, if liquid ink is filled to the pressure chamber 3 of the formed ink jet head via the ink feed path 2 and the piezoelectric device 12 is changed into it by voltage impressing, The diaphragm 11 vibrates, a discharge pressure is applied to the liquid ink in the pressure chamber 3 by it, and an ink droplet is breathed out from the nozzle hole 9.

[0019]This invention is not limited to the above-mentioned working example, may use nickel, photosensitive glass, etc. for the substrate 1, for example, and them as the filler 4, The material which can dissolve in solvents, such as thermoplastics, such as paraffin wax and polycarbonate, or poly vinyl alcohol, and polystyrene, may be used.

[0020]As an order of processing, the first bigger hole 5 than the nozzle hole 9 is formed in the side front of the substrate 1, An order of processing, such as forming the pressure chamber 3 and the ink feed path 2 in the back side of the substrate 1, after forming the nozzle hole 9 furthermore, may be changed, and after pasting up the diaphragm 11 on the rear face of the substrate 1, it may be made to begin to pour the filler 4.

[0021]

[Effect of the Invention]According to the manufacturing method of the ink jet head of this invention, a nozzle hole irradiates photo-curing resin, can form it in an exact shape dimension with high precision, and, moreover, portions other than the circumference of a nozzle hole, Since it can form with an inorganic material with mechanical strengths, such as metal, glass, or a silicon single crystal in which mechanical strength excelled photo-curing resin, an unnecessary vibration does not occur, but sufficient discharge velocity of an ink droplet is obtained, and the stable print quality can be acquired.

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